Appln. No. 10/665,846
Amendment dated September 17, 2008
Office action of March 17, 2008

**PATENT**

## IN THE CLAIMS

**Listing of Claims:**

1.      (currently amended) A method for storing data, comprising:

transmitting a storage operation request to one of at least two controllers, the at least two controllers being capable of managing communication with a plurality of targets;

directing the storage operation request to an operational one of at least two controllers when the one of at least two controllers is inoperable through an L4 router, the directing including,

generating an external queue pair (QP) for establishing communication between the L4 router and an external host through a reliable connection (RC) session, and

generating internal queue pairs, one of the internal queue pairs being coupled with the external queue pair, the internal queue pairs establishing communications between the at least two controllers and an internal target device, between the L4 router circuitry and the at least two controllers, and between the L4 router circuitry and the internal target device by using reliable datagram (RD) sessions; and

processing the storage operation request with the operational one of the at least two controllers.


2.      (original) A method for storing data as recited in claim 1, further comprising:

communicating data for storage operations using to the at least two controllers through a network fabric interconnect.

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3.      (original) A method for storing data as recited in claim 1, further comprising:

communicating data between at least one storage device and at least one host using the operational one of the at least two controllers.

4.      (original) A method for storing data as recited in claim 1, wherein the storage operation request is one of a request to store of data to a target and a request to read data from a target device, the target device being a storage device.

5.      (original) A method for storing data as recited in claim 1, wherein the directing of the storage operation request includes the storage operation request through an L4 router.

6.      (original) A method for storing data as recited in claim 5, wherein the transmitting the storage request includes communicating data between a host and at least two storage devices through one of at least two L4 routers and one of the at least two controllers wherein an operable one of the at least two L4 routers is used when one of the at least two L4 routers is inoperable, the at least two L4 routers being capable of facilitating remote direct memory access (RDMA) communications between the at least two target devices and the host wherein the router uses information at a transport layer to route data between transport sessions.

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7.    (original) A method for storing data as recited in claim 2, wherein the network fabric interconnect is an InfiniBand-type fabric, and the at least two controllers are RAID controllers.

8.    (original) A method for storing data as recited in claim 7, wherein the transmitting the storage operation request includes transmitting the request through an operational one of at least two bridge chips.

9.    (original) A method for storing data as recited in claim 8, wherein the at least two bridge chips are SATA-IB chips.

10.    (original) A method for storing data as recited in claim 2, wherein the directing the storage operation request includes determining a correct path through the network fabric interconnect to a proper storage device.

11.    (currently amended) A method for storing data, comprising:

providing a plurality of storage containers, each one of the plurality storage containers having a plurality of storage devices;

generating a plurality of storage volumes where each one of the storage volumes includes at least one storage device from each one of the plurality storage containers;

managing each of the plurality of volumes with a corresponding storage device controller; and

when the corresponding storage device controller is inoperable,

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accessing data on the plurality of storage volumes through at least one operable storage device controller that is configured to access the volume managed by the inoperable storage device controller, the accessing through an L4 router, and including,

generating an external queue pair (QP) for establishing communication between the L4 router and an external host through a reliable connection (RC) session, and

generating internal queue pairs, one of the internal queue pairs being coupled with the external queue pair, the internal queue pairs establishing communications between the at least two controllers and an internal target device, between the L4 router circuitry and the at least two controllers, and between the L4 router circuitry and the internal target device by using reliable datagram (RD) sessions;.

12.    (original) A method for storing data as recited in claim 11, further comprising:

assigned control of each of the plurality of storage volumes to a corresponding separate controller.

13.    (original) A method for storing data as recited in claim 11, further comprising:

when a controller for a particular storage container fails,

accessing data located on other storage containers through XOR operations.

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14.    (original) A method for storing data as recited in claim 11, further comprising:

managing the plurality of storage volumes by spreading the processing of input/output requests among all of a plurality of controllers, each of the plurality of controllers controlling a corresponding one of the plurality of storage volumes.

15.    (original) A method for storing data as recited in claim 11, wherein the storage containers are RAID devices.

16.    (original) A method for storing data as recited in claim 11, wherein the storage devices are disk drives.

17.    (currently amended) A method for transmitting data in a data storage system with at least two RAID controllers and at least two L4 routers, comprising:

determining functionality of the at least two L4 routers;

during a read operation,

communicating the data from a storage device to a functional L4 router;

determining at least one destination host for the data,

transferring the data to the at least one destination host using L4 routing;

and

during a write operation

communicating the data from a host to a functional L4 router,

determining at least one destination storage device for the data,

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transferring the data to the destination storage device using L4

routing, wherein the transferring includes,

generating an external queue pair (QP) for establishing

communication between the L4 router and an external host through a

reliable connection (RC) session, and

generating internal queue pairs, one of the internal queue pairs

being coupled with the external queue pair, the internal queue pairs

establishing communications between the at least two controllers and

an internal target device, between the L4 router circuitry and the at

least two controllers, and between the L4 router circuitry and the

internal target device by using reliable datagram (RD) sessions.

18.    (original) A method for transmitting data in a storage system as recited

in claim 17, wherein communicating the data from a storage device to a functional L4

router and communicating the data from the host to the functional L4 router includes

transmitting the data through an SATA-IB bridge and a network fabric.

19.    (original) A method for transmitting data in a data storage system as

recited in claim 17, wherein the network fabric is an InfiniBand-type fabric.

20.    (original) A method for transmitting data in a data storage system as

recited in claim 17, wherein the L4 routing includes using RDMA data transfer.

21.    (currently amended) A storage network architecture, comprising:

at least two target devices;

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at least two controllers for managing the at least two target devices, each of the

at lest two controllers configured to be capable of managing the at least two target

devices when one of the at least two controllers is inoperable;

at least two switches connecting the at least two controllers and the at least two

target devices; and

at least two L4 routers, each one of the at least two L4 routers being capable of

communicating data between a host and the at least two target devices through one of

the at least two switches and one of the at least two controllers, the L4 router being

capable of facilitating remote direct memory access (RDMA) communications

between the at least two target devices and the host wherein the router uses

information at a transport layer to route data between transport sessions the at least

two L4 routers including,

circuitry for generating an external queue pair (QP) for establishing

communication between the L4 routers and the host through a reliable connection

(RC) session, and

circuitry for generating internal queue pairs, the internal queue pairs

establishing communication between the L4 routers and the at least two controllers,

between the at least two controllers and the at least two target devices, and between

the L4 routers and the at least two target devices by using reliable datagram (RD)

sessions.


22.    (original) A network architecture as recited in claim 21, wherein each

one of the at least two L4 routers utilizes at least one internal queue pair to

communicate with at least one external queue pair of the host.

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Claims 23-29 cancelled

30.    (original) A network architecture as recited in claim 21, wherein the at least two controllers are RAID controllers.

31.    (original) A network architecture as recited in claim 21, wherein the plurality of targets is a plurality of storage devices.

32.    (original) A network architecture as recited in claim 21, wherein the plurality of storage devices is a plurality of disk drives.

33.    (original) A network architecture as recited in claim 21, wherein when one of the at least two L4 routers is inoperable, the inoperable one of the least two L4 routers is capable of communicating data between the host and at least two target devices.

34.    (original) A network architecture as recited in claim 21, wherein one of the at least two switches is inoperable, the inoperable one of the at least two switches is capable of communicating data between the host and at least two target devices.